REMARKS

Claims 1, 2 and 5 are all of the claims pending in the application.

I. Claim Rejections under 35 U.S.C. 103(a)

Claims 1, 2 and 5 were rejected under 35 U.S.C. 103(a) as being unpatentable over Gali et al. (U.S. Re. 35,643) in view of Chiang et al. (U.S. 6,479,966), Kondo (U.S. 6,730,428) and Gali et al. (U.S. 5,633,575).

Claim 1, as amended, is directed to a method for removing membranous lead sulfate deposited on electrodes of a lead-acid battery due to sulfation, and recites the feature of applying a negative pulse current having a current value in a range of 10 to 120 mA. Applicant respectfully submits that the cited prior art references do not teach or suggest such a feature.

For example, regarding the Gali (Re. 35,643) reference, Applicant notes that while this reference discloses a method for rejuvenating a lead acid battery using a short duration voltage pulse on the order of 5 μs or less (see col. 4, lines 27-29), that Gali does not disclose or in any way suggest the use of a negative pulse current having a current value in a range of 10 to 120 mA, as recited in amended claim 1.

In addition, regarding the Chiang reference, Applicant notes that while this reference discloses a method of reconditioning a lead acid battery using rapid periodic pulse signals generated from an A/C power source (see col. 2, lines 17-19), that Chiang does not disclose or in any way suggest the use of a negative pulse current having a current value in a range of 10 to 120 mA, as recited in amended claim 1.

Further, regarding the Kondo reference, Applicant notes that this reference discloses a method of recycling a lead acid battery using a pulsating direct current of about 1 to 8 Amps (see col. 6, lines 23-27). As such, Applicant submits that Kondo clearly does not teach or suggest the use of a negative pulse current having a current value in a range of 10 to 120 mA, as recited in amended claim 1.

Lastly, regarding the Gali (U.S. 5,633,575) reference, Applicant notes that while this reference discloses a method of recharging a lead acid battery using pulse envelopes having a fast rise time (see col. 1, lines 51-53), that Gali does not disclose or in any way suggest the use of a negative pulse current having a current value in a range of 10 to 120 mA, as recited in amended claim 1.

In view of the foregoing, Applicant respectfully submits that the cited prior art references, either taken alone or in combination, do not teach, suggest or otherwise render obvious the feature of applying a negative pulse current having a current value in a range of 10 to 120 mA, as recited in amended claim 1.

Accordingly, Applicant submits that claim 1 is patentable over the cited prior art, an indication of which is kindly requested. Claims 2 and 5 depend from claim 1 and are therefore considered patentable at least by virtue of their dependency.

In addition, Applicant notes that claim 1 also recites that the negative pulse current has a short pulse width of less than 1 μs. Applicant respectfully submits that the cited prior art references also do not render obvious this feature of claim 1.

Regarding such a feature, as noted above, Gali (Re. 35,643) discloses the use of a short duration voltage pulse on the order of 5 μs or less. In this regard, as noted by the Examiner in the Office Action, if a claimed range overlaps or lies inside a range disclosed by the prior art, then a *prima facie* case of obviousness exists (see MPEP 2144.05(I)).

With respect to such a position, however, Applicant points out to the Examiner that MPEP 2144.05(III) indicates that "Applicants can rebut a *prima facie* case of obviousness based on overlapping ranges by showing the criticality of the claimed range" (emphasis added). In this regard, Applicant respectfully submits that the claimed range of less than 1 μs achieves new and unexpected results which renders claim 1 unobvious.

In particular, regarding the claimed pulse width, Applicant notes that the specification clearly indicates that a pulse current with a pulse width of over 1 μs is ineligible because it causes thermal oscillation in a boundary face between the membranous lead sulfate deposit and the electrode, consequently permitting the lead sulfate deposit on the electrodes to exfoliate and fall off (see page 6, lines 5-8 of the original specification).

In this regard, Applicant points out that Gali explicitly discloses that through the application of pulse signals of very short duration in the order of 5μs or less time width wise, lead sulfate deposits that have occurred on battery plate surfaces will be **released**, either going back into solution or broken up (see col. 1, lines 60-61 and col. 2, lines 2-4).

Applicant has recognized, however, that there are multiple problems associated with the practice of applying pulse currents to a battery to release lead sulfate deposits from the battery

plate surfaces, as disclosed in Gali. Specifically, there are problems associated with lead sulfate going back into solution and problems with broken up lead sulfate.

For example, as the lead sulfate goes back into solution, the specific gravity of the electrolytic solution may become excessively elevated, thereby resulting in damage to the polar plates and a decrease in the life of the battery (see page 2, lines 25-27 of the original specification). Also, when the lead sulfate is broken up, the flakes fall onto the peripheries of the lower parts of the polar plates or are suspended without dissolving in the electrolytic solution. Consequently, the flakes may thus again be deposited on the polar plates of the battery during discharging (see page 2, lines 13-16 of the original specification).

Thus, Gali teaches exactly the practice Applicant has identified as being associated with the aforementioned problems, specifically, the application of a pulse current having a pulse width which is **only** disclosed as being less than 5 μs.

On the other hand, as discussed above, Applicant has discovered that by utilizing a negative pulse current having a negative pulse width of less than 1 μs, the membranous lead sulfate can be sequentially dissolved into fine particles, thereby preventing flaking.

In view of the foregoing, Applicant submits that even though Gali teaches the application of a pulse width "less than 5μs", due to the new and unexpected results that are obtained by utilizing a pulse current having a pulse width of less than 1 μs, that a *prima facie* case of obviousness has been rebutted in accordance with MPEP 2144.05(III). Accordingly, Applicant submits that claim 1 is patentable over the cited prior art references, an indication of which is kindly requested.

II. Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that the present application is clearly in condition for allowance. An early notice thereof is earnestly solicited.

Respectfully submitted,

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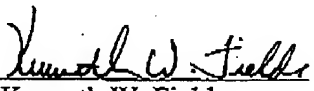
By: 

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